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Albert

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(54) **ELECTROPHORETIC DISPLAYS WITH LUMINESCENT PARTICLES AND MATERIALS FOR MAKING THE SAME**

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(56) **References Cited**

U.S. PATENT DOCUMENTS

2,800,457 7/1957 Green et al. .
3,384,488 * 5/1968 Tulagin et al. .

(List continued on next page.)

FOREIGN PATENT DOCUMENTS

195 00 694 A1 8/1996 (DE) .
0 240 063 B1 10/1987 (EP) .

(List continued on next page.)

OTHER PUBLICATIONS

Sankus, "Electrophoretic Display Cell," *Xerox Disclosure Journal,* May/Jun. 1979, vol. 4, No. 3, (p. 309).

(List continued on next page.)

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(57) **ABSTRACT**

Disclosed herein are novel electrophoretic displays and materials useful in fabricating such displays. In particular, novel encapsulated displays are disclosed. Particles encapsulated therein are dispersed within a suspending, or electrophoretic, fluid. This fluid may be a mixture of two or more fluids or may be a single fluid. The displays may further comprise particles dispersed in a suspending fluid, wherein the particles contain a liquid. In either case, the suspending fluid may have a density or refractive index substantially matched to that of the particles dispersed therein. Finally, also disclosed herein are electro-osmotic displays. These displays comprise at least one capsule containing either a cellulosic or gel-like internal phase and a liquid phase, or containing two or more immiscible fluids. Application of electric fields to any of the electrophoretic displays described herein affects an optical property of the display.

7 Claims, 14 Drawing Sheets